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Federal Communications Commission
Office of Engineering and Technology
Laboratory Division
Test procedures for Notebook Computers Based on Assembly Using Separately Authorized Motherboard, Enclosures, Power Supplies and Other Devices

1.0 Introduction

Approvals for computer system components in accordance with Sections 15.101(c) (2) or (c) (3), and when the resulting product is not separately tested, require that the individual devices be separately authorized under the Declaration of Conformity or Certification process and separately tested under the procedures of section 15.31 or 15.32. The guidelines below provide clarification specifically for notebook motherboards, enclosures, outboard power supplies or other devices.

A notebook computer enclosure unlike a desktop computer enclosure is treated like a peripheral device because it contains active circuitry typically integrated with a video display unit, keyboard, and touchpad components.

Separately authorizing all the individual devices allows a party to market and sell a complete notebook computer assembled in accordance with Sections 15.101(c) (2) or (c) (3) without further testing under the provisions of Section 15.202.

1.1 Notebook Computer Nomenclature

A notebook computer enclosure is composed of 4 basic parts, called shells. These shells are labeled A, B, C and D. The A shell covers the back of the video display and forms the top of the assembly when the notebook computer is closed. The B shell is the part through which the video display is viewed and forms the second half of the enclosure for the display. The C shell forms the top of the lower portion of the notebook computer. The keyboard, touch pad and other on-enclosure components penetrate the C shell. The D shell forms the bottom of the computer. The picture below in Figure 1 shows a typical notebook computer.

2.0 Power Supplies

Power supplies for notebook computers are typically external to the computer and approved under the Verification approval procedure and using appropriate test procedures as outlined in Section 15.31 for a computer peripheral device.

2.1 Test Process and Limits

Testing shall be in accordance with the procedures specified in Section 15.31 and must demonstrate compliance with all of the standards contained in this Section. As a notebook computer power supply is typically an external part, it will not be installed in the enclosure,

but rather in its typical fashion. A representative notebook computer will be used as the load for the power supply in these tests. When configured with a typical notebook computer the power supply shall meet the Class B limits for power line conducted emissions in Section 15.107(a) and for radiated emissions in Section 15.109(a) of the FCC Rules.

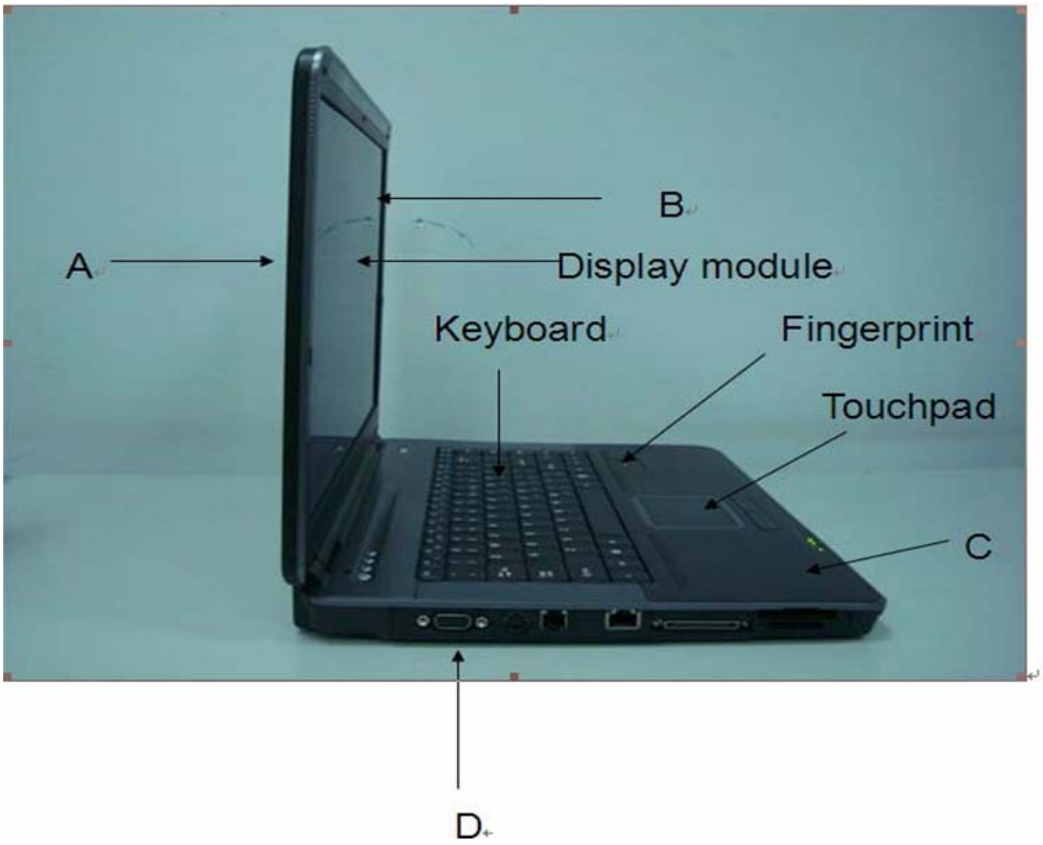

Figure 1 shows a typical notebook computer

3.0 Notebook computer motherboard

3.1 Test Process and Limits

Section 15.32 (a)(1) potentially requires two tests. A test with the cover off and, if the limits in Section 15.109(a) are not met, a test with the cover in place. The cover off test is easily performed with a desktop computer. The monitor is placed to one side of the enclosure and the cover is removed. The purpose of the cover off test is to evaluate the performance of the CPU Board by removing the shielding effects from the cover of CPU board enclosure and at least 2 vertical sides between the cover and the bottom side of the CPU board enclosure while maintaining the conductive plane at the bottom of the CPU board to serve as common (ground) plane for return current, i.e. 3 opened sides. While the cover of a desktop unit may be removed without displacing other parts of the system, including internal cables, this is not the case for a typical notebook computer. While testing of a notebook has been performed on several units by hinging open the “C” shell of the enclosure, this results in abnormal placement of the keyboard and touchpad. If the top side of the “C” shell is designed with

shielding effects features (e.g. metal, conductive filled plastic and conductive coating), a special “C” shell shall be used for the sole purpose of evaluating the emissions from the CPU Board. These special shells shall be made of plastic with no conductive properties that would enable them to provide shielding for emissions from components contained within them. The “A” and “B” shells would be of normal structure as “A” and “B” shells house the display and associated circuitry. The bottom side of the “D” shell will be the enclosure common plane to accommodate the CPU board. At least 2 of the 4 vertical sides of the CPU enclosure should be designed without shielding effects for the “cover off” or open enclosure test. The requirement for the top side of the “C” shell is extended to these unshielded vertical sides. For note book computers, the 4 vertical sides are not always part of the D “shell”, sometimes they or some of them are part of the “C” shell. The following Figure 2 and Figure 3 show an example of the top side of the “C” shell for both with and without shielding. Both the conductive coating on the enclosure and conductive plates (or similar) shall be removed for the “cover off” test. Any mounting or interface function provided by the shielding parts will be accomplished via other means. The preferred way to accomplish the removal of shielding from any area is to remove shielding material if present. Special unshielded parts should be made only if this option is not possible.

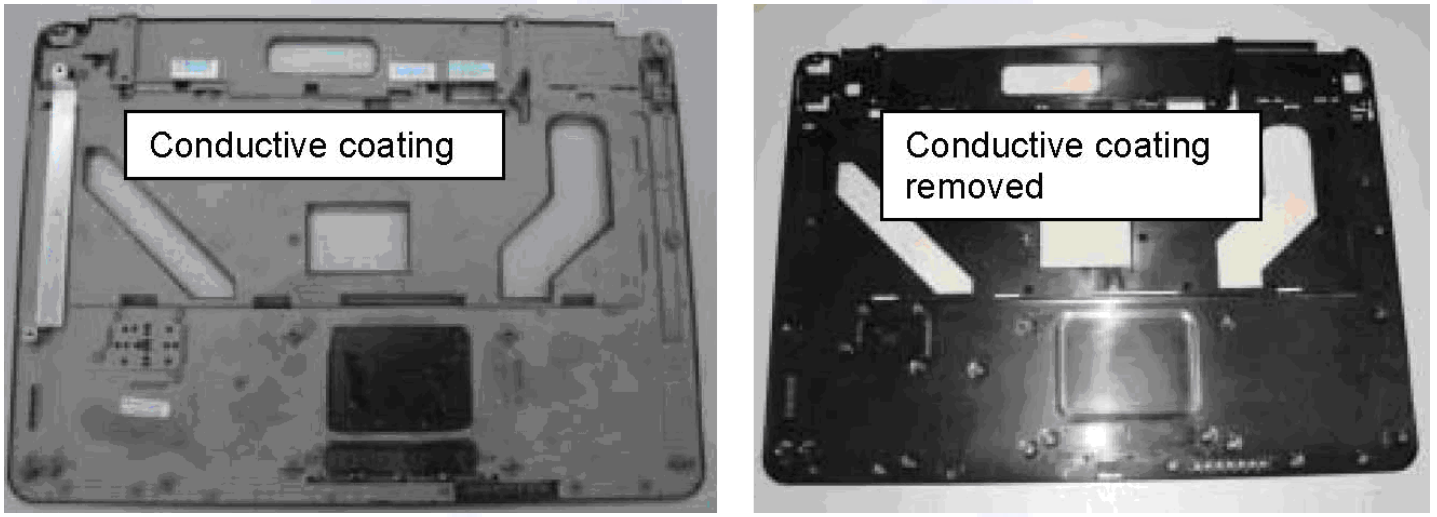

Figure 2: “C” Shell (with and without conductive coating on the top side)

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Figure 3: Installation of a “C” Shell (with and without conductive coating on the top side) on complete system

The notebook computer keyboard which is part of the complete setup of the notebook computer is normally manufactured with a conductive plate at the base of the keyboard (illustrated in Figure 4). The conductive plate is intended for thermal heat dissipation, as well as housing the circuitry for keyboard. For cover off testing, the conductive base shall be replaced with non conductive material to remove the effect of shielding when it is installed on top of the notebook computer system above the CPU board in the typical setup. Removing the conductive base could potentially cause keyboard related EMI issues due to the removal of the common reference plane for the keyboard circuitry (if needed). An equipment authorization request for a notebook with emission or emissions greater than 6 dB over the limit that can be identified and documented to originate from the keyboard, may be dismissed (in accordance with the FCC Rules). This requirement is extended to other components which are designed as parts of the top side of the “C” shell including touchpad, fingerprint reader, etc.

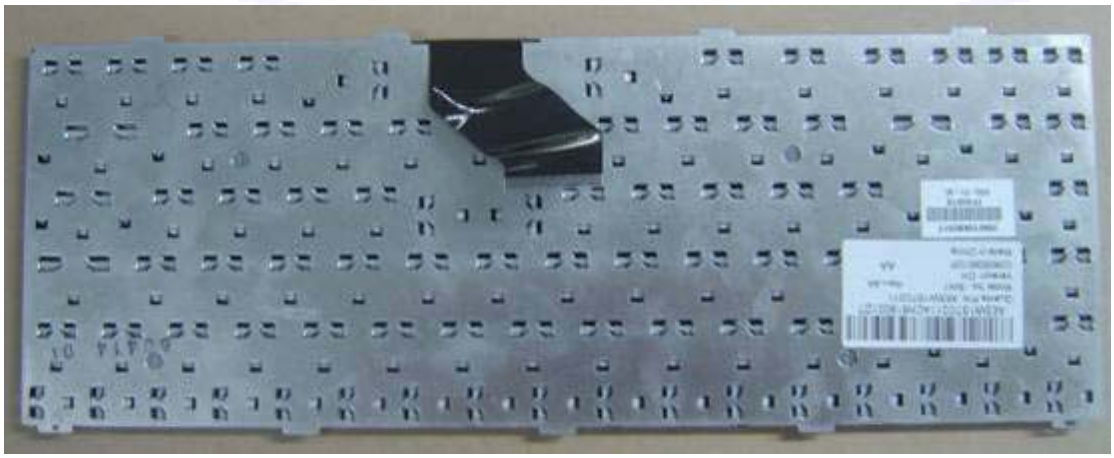

Figure 4: Conductive plate at the base of the keyboard

Radiated emissions testing will therefore be performed in two separate housings. The “cover off” test, where emissions are allowed to exceed the limits in Section 15.109(a) by up to 6 dB, will be performed in a special enclosure where the shielding effects of at least 2 vertical sides and the top side of the “C” shell including the components like keyboard, touchpad and fingerprint reader are removed as mentioned above.

All other aspects of this test will be as normally required under Part 15 of the FCC Rules and ANSI C63.4-2003. The “cover on” test, where emissions may not exceed the limits in Section 15.109(a), will be performed in a normal, representative enclosure.

4.0 Enclosure Combination

For the DoC process outlined in the FCC Rules for integrated personal computers there is no approval process described or required for the enclosure in which the system is integrated. For such systems the enclosure is little more than sheet metal to hold the system components together. In a notebook computer, however, the enclosure serves one additional key function. In a desktop system the Video display unit is typically a separate, external, peripheral device. In a notebook computer the video display unit is typically an integral part of the enclosure, installed inside the “A” / “B” shell part of the enclosure. The keyboard, touchpad and some other possible components in the enclosure are typically unique to a specific enclosure at this time. This combination should be treated as a peripheral device and authorized as such under 15.31. The following is for qualification of a enclosure /display / keyboard / touchpad and some other possible components in the enclosure combination.

4.1 EUT (Equipment Under Test) Configuration

The unique enclosure/display/keyboard/touchpad/finger print, etc. combination to be tested shall be installed as part of a complete notebook computer. All necessary additional components (e.g. hard drive, memory, mother board) and external devices (e.g. power supply, external peripheral devices connected to I/O ports) shall be connected to create a complete system. Any change in the configuration of the enclosure, video display (including support electronics) is subject to the permissive change requirements in Section 2.1043.

4.2 Test Procedure

The notebook computer system, configured per Section 4.1 of this document, shall meet the Class B limits for power line conducted emissions in Section 15.107(a) and for radiated emissions in §Section 15.109(a) of the FCC Rules. Testing shall be performed using the methods documented in ANSI C63.4-2003.

Change Notice:

657217 D01 Notebook CPU Brds and Pwr Suply v01r01 replaces 657217 D01 Notebook CPU Brds and Pwr Suply v01

Item 2.0 changed:
2.0 Power Supplies
Power supplies for notebook computers are typically external to the computer and separately approved using the procedures outlined in Section 15.31 as a computer peripheral device;

was changed to:

2.0 Power Supplies
Power supplies for notebook computers are typically external to the computer and approved under the Verification approval procedure and using the same test procedures outlined in Section 15.31 for a computer peripheral device.